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The Control of Engagement Order

We have examined this order with some care, and are not impressed with either its wording or its implications. Pre-publication propaganda led one to believe that a serious attempt was to be made to deflect " spivs " from the black market, gambling businesses and the like, into productive employment. Yet it does nothing of the kind; so long as a person avoids the labour exchanges, he is free to pursue his chosen activities, or indeed set himself up in a one-man business. At this stage he can apply to the authorities for help and so become " respectable." The original order states: " With certain exceptions, all men aged 18 to 50 inclusive, and women aged 18 to 40, are covered by the Order "; and " An employer may not engage or even seek to engage (*e.g.*, by advertisement, poster or circular letter) any worker to whom the restrictions apply, otherwise than through a local office of the Ministry of Labour and National Service or an Employment Agency approved for the purpose." Within a few days the Government issued a supplementary order which speaks of the granting to employers of exemption certificates—the details of which have still to be disclosed—and issue to employees of " permits " where a functionary at the local exchange decides that the man can best shift for himself. The interesting part of this supplementary order is the complete divorce of anybody above the position of a working foreman from its provisions. Our interpretation is that all non-working foremen, metallurgists, managers and executives are exempted. Moreover, we believe that if a man feels himself qualified by experience and study to fill some major or minor executive position, he can advertise for such a post. The test seems to be, if a person has executive authority he or she is exempt.

As an order this new edict on its own is virtually useless, as for many years a very high percentage of manual labour has been engaged through the local labour exchanges, whilst " staff " vacancies have been filled through advertisements. The sole industrial class to be affected are the clerks and typists; as in the past they were regarded as " staff." On a long-term policy it would have a profound effect, but the order is due to expire at the end of 1948, and its futility as it stands at the moment is that it does not add a single person to the industrial working force. Of course, it may be that some sort of industrial concentration will be introduced, but the difficulties of this in peacetime are almost insuperable. Luxury industries, such as cosmetics, may, we do not know, stand very high on the priority list because of their export potentialities. The main industry likely to be affected by present conditions is that of building; this in theory should have an adverse repercussion on the light iron castings foundries. However, the export position for baths is distinctly bright, and since buildings already started are to be completed, there is sufficient work in sight to keep the gutter and fall-pipe sections busy for a prolonged period. Heavy pipe, too, should not experience any pronounced falling off of orders for the duration of these regulations, as there is so much leeway to be made up.

Thus we cannot envisage any serious changes in the labour position in the ironfoundry industry. In the non-ferrous and light alloy divisions, however, there may be, here and there, some major changes, but the versatility inherent in these sections makes them well capable of meeting any new conditions. Its exercise will enable them to retain their staffs. To realise the full effect of this Control of Engagement Order, one must await other Government actions which may have a major influence on the conduct of one's business.

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French Foundry Conference

The 21st Congress of the Association Technique de Fonderie opens next Monday (October 13) at 9 bis, Avenue d'Lena, Paris 16, under the presidency of Dr. Bastien. The opening address will be given by Mr. R. Norguet at 9.30 a.m. on Mechanisation and Modernisation of Foundries. Detailed aspects of this subject are to be given by Mr. R. Kenner (Upkeep); Mr. H. Perchat (Sand Handling); Mr. P. Rigaut (Knock-out); Mr. G. Cros (Fettling). The afternoon session (3 p.m.) is to be devoted to a variety of subjects, to include the American Exchange Paper by Mr. T. W. Curry on "Chemically Treated Sand—a Moulding Sand Process with a Resin Bond"; Mr. P. Dauxois on "Representation of a Granulometric Distribution"; Mr. P. Nicolas on "The Qualities of Various French Rammed Lining Materials compared with some Foreign Ones"; and Mr. J. Pascal on "Special Eccentric Strickles for Cylindrical Moulding having Machined-up Accessories."

The morning session (9.30 a.m.) on Tuesday (October 14) is to be devoted to the Mechanical Testing of Cast Iron. The first paper, presented on behalf of the Institute of British Foundrymen, is by Dr. A. B. Everest on Shock Testing. This is followed by Dr. A. Collaud (Switzerland) on "The Mechanical Properties of Grey Cast Iron and the Improvement of their Behaviour in Service"; Mr. J. Léonard on "Test Pieces for Cast Iron"; Dr. Lepp and Mr. Charron on "The Mechanical Characteristics of Grey Irons"; and Mr. J. Prache on "The Mechanical Tests of Grey Irons." The afternoon session is of a general character. The first paper—an official one from Belgium—is by Mr. J. Goffart, who is dealing with "Iron for Thin-sectioned Castings." The balance of the papers are:—Dr. Bastien and Miss Daeschner on "The Corrosion of Irons by Aluminium and Light Alloys of the Alpax Type"; Mr. G. Joly on "Malleablising Furnaces"; and Professor Girardet and Mr. A. Guedras on "The Cementation of Cast Iron by some Metalloids and Metals."

The final session, to be held on Wednesday morning (9.30 a.m.), is to be devoted to light alloys. The following papers are to be presented:—Mr. L. Grand on "The Degassing of Aluminium Alloys"; Mr. J. Herenguel on "Influences of the Solidification Conditions on the Type and the Arrangement of the Constituents of the Foundry"; Mr. R. Bourret on "An Automatic Machine for the Die Casting of Aluminium Alloys"; and Count de Fleury and Mr. Bardot on "The Current Quality Troubles and their Effect on the Cost Price." Finally Dr. Bastien will summarise the lessons to be learnt from the Congress.

MR. D. W. HAMMOND, chief metallurgist of Crofts (Engineers), Limited, power transmission engineers, Thornbury, Bradford, has been elected president of the West Riding branch of the Institute of British Foundrymen. The first meeting of the branch will be held on October 11, and visits to three of Yorkshire's leading engineering firms have already been arranged for its members during the winter.

Forthcoming Events

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

OCTOBER 14.

Imperial College of Science and Technology.

"Enamelled Cast Iron as a Material for Chemical Plant," by W. E. Benton, at 4.30 p.m., at Department of Chemical Engineering and Applied Chemistry, Prince Consort Road, South Kensington, London.

OCTOBER 14.

Institution of Production Engineers.

Birmingham Graduate Section:—"Foundrywork and Production," by G. Biddle, at the James Watt Memorial Institute, Great Charles Street, Birmingham, at 7.15 p.m.

OCTOBER 15.

Birmingham Section:—"Payment by Results Critically Examined," by E. C. Gordon England, at the James Watt Memorial Institute, Great Charles Street, Birmingham, at 7 p.m.

Liverpool Sub-section:—"Die-Casting of Light Alloys," by H. W. Fairbairn, at Liverpool University, at 7.15 p.m.

OCTOBER 16.

Glasgow Section:—"Colour Schemes for Factories and Machines," by S. A. Wood, at the Institution of Engineers and Shipbuilders in Scotland, Glasgow, at 7.30 p.m.

OCTOBER 15 and 16.

Institute of Metals.

Symposium on Internal Stresses in Metals and Alloys (Paper No. 1089 on "Stress Relief Treatment of Iron Castings" is included), at the Institution of Mechanical Engineers, Storey's Gate, Westminster, London, S.W.1. October 15, 10 a.m. to 8 p.m.; October 16, 10 a.m. to 5 p.m.

OCTOBER 15.

Institute of British Foundrymen.

London Branch:—Works Visit to British Bath Company, Limited, Greenford. Assemble at Main Gate, 2.30 p.m.

OCTOBER 15.

East Midlands Branch—Lincoln Section:—"Malleable Cast Iron," by J. D. Lelshman, at the Lincoln Technical College, at 7.15 p.m.

Visual Education

We have received from Educational Publicity, Limited, of 17, Denbigh Street, London, S.W.1, Part 4 of their series of lecture notes and film strips covering foundry technique. This one deals with the making of a simple two-part bench mould. The exceptional clarity of both the film and the notes are outstanding. Wherever lecturers are finding that the City & Guilds syllabus is too advanced for students with war-damaged education, they can rest assured that this series of film strips is ideal for inculcating pride of craft and interest in foundry practice into the most recalcitrant of students.

Rainwater Goods in India

It is reported authoritatively from India, that since the adoption by the local foundry industry of British Standard Specifications for gutters and fall pipes, there is real difficulty in dealing with the heavy monsoon rains. Maybe the seasonal nature of the rainwater which mitigates against the regular swilling out of the pipes is also a factor.

Nottingham Discussion

Graphite Formation in Grey Cast Iron

By H. Morrogh and W. J. Williams**

At the conference of the Institute of British Foundrymen the presentation of this Paper created exceptional interest because of its link-up with the new metallurgical development recently announced by the British Cast Iron Research Association.

MR. J. G. PEARCE (Director, British Cast Iron Research Association), opening the discussion, said in his lecture that morning Sir Edward Appleton had indulged in a little leg-pull at their expense and said something to the effect that if they did not get to know the things they wanted from Mr. Morrogh and Mr. Williams in the Paper, they should ask for them in the discussion. Mr. Pearce felt it was necessary for him to explain that at about Christmas of last year the Cast Iron Research Association had announced the discovery of a nodular graphite iron. That was an iron with a graphite structure in the mould in the as-cast state, and with nodules or spherulites which rather resembled the graphite structure in malleable cast iron, and it was obviously a matter of interest, because only by the long annealing of white iron had it been hitherto possible to produce that structure. The whole matter was a little bit complicated, because the present Paper was written before that discovery was made, and it would not be quite fair to ask the Authors to answer questions on a matter about which no Paper had yet been prepared, but Mr. Pearce was prepared to answer any questions that might be in the minds of anybody present with respect to that particular material, with certain very definite limitations. In that connection, he would like them to understand the Association's position in the matter.

The New Material

From an ordinary run-of-the-mine hematite pig-iron foundrymen would be able, by a ladle treatment, to get castings which were soft to machine, absolutely sound, and having two or three times the tensile, transverse or shock strength of the same material in the untreated state, solely due to the fact that the graphite was transformed from the flake structure obtained in the ordinary casting to the nodular type of which he had spoken. It was possible in fact to get properties which were associated with those of high-duty iron. Moreover, there would be available a material which could be subjected to precisely the same processes of improvement by alloy additions or by heat-treatment that had distinguished the development of high-duty iron during the last 25 years.

*British Cast Iron Research Association.

Mr. Pearce wanted to make it quite clear that, although this material had the nodular graphite structure usually obtained in malleable iron (the so-called temper carbon structure), it had no ductility. It was not to be compared with malleable in that respect. It had slight elongation and slight reduction of area in the as-cast state.

The whole position, when a development of this kind took place, was that they had a duty to members to report it, but there were other interests to watch as well, and for a short time it would be necessary to keep the matter confidential, although this would not interfere with its proper development by members.

Theoretical Extensions

MR. D. FLEMING said that in the course of a research with wide terms of reference, one of those unexpected developments had cropped up which tended to turn interests in a new direction, but nevertheless the analogy between nickel-carbon alloys and cast iron was a notion which could be profitably applied to a number of foundry problems. He noticed that the materials which had given an effect, specifically calcium and magnesium, were linked up with other members of the same periodic group. He inquired as to why molybdenum was omitted from that group or whether it had been investigated, or was that treading on thin ice? As the effect from calcium to magnesium was traced through, apparently calcium did not appear to continue to be quite so effective; and as they went from nickel to cobalt, magnesium stepped in and took its place. When they reverted to the treatment of the iron-carbon-silicon group, one of his first reactions was to wonder whether magnesium retained its effectiveness or whether other elements were more useful.

MR. MORROGH, in reply, said there appeared to be no obvious connection between the position of the element added to the nickel-carbon alloys and its position in the periodic group.

The Rôle of Calcium Silicide

Mr. Morrogh said he would like to make it clear that two things were being discussed, (1) alloys based upon iron, and (2) alloys of the pure nickel-carbon type. When adding calcium, magnesium and barium to those alloys, those elements dissolved and alloyed with the metal concerned and also behaved as desulphurisers. He had conducted a number of experiments, quite naturally, in an attempt to alloy calcium and magnesium and similar elements with cast iron, but as far as he knew, it had been impossible to do that. Generally speaking, one could not expect calcium to exist in an iron-carbon or in a cast iron melt as long as there was sulphur present in that melt, and it was quite common knowledge that an addition of calcium silicide to the melt removed sulphur. He, himself, was not certain that the element calcium played any significant part in the inoculating influence of calcium silicide.

In reply to a question upon inverse chill, Mr. Morrogh said there was no segregation of elements that he had been able to find, neither was there any

Graphite Formation

segregation of minor phases. Graphitisation arising after under-cooling occurred with a marked expansion. If the casting was fed as a white cast iron, the casting would expand and would have ultimately dimensions higher than a grey casting cast into the same mould. In certain castings, it was conceivable that the white iron in the centre was very strongly restricted by the pressure of the outer portions so that graphitisation was inhibited in that way. This condition most probably existed when there was very complete feeding.

Mr. Dunlop said under the section headed "Inoculation," reference was made to the use of calcium silicide, and the inference was made that the silicon was the outstanding factor. In Mr. Morrogh's earlier remarks, he had talked about calcium having a similar effect. Was that correct?

Mr. Morrogh replied that calcium had a similar effect to calcium silicide in nickel carbon alloys. The section on inoculation referred to carbon alloys.

How Oxygen May Act

Mr. Dunlop said with regard to the carbon alloys he believed it was possible, if oxygen was completely removed from iron, to make a casting which was iron and carbon only. The fact that a carbide form was obtained was tied up in some way with the presence of oxygen. He had heard experiments had been done of melting iron and carbon in very high vacuum and then iron-carbons were obtained, but as soon as the least trace of oxygen were present, white iron was obtained. He had wondered if these inoculators, which all appeared to be powerful deoxidisers, did something to the iron-oxide-carbon system, if there was such a thing. He believed it was a fact the work had never been published, but it had been done by a colleague many years ago, who assured him he could make iron with carbon as free carbon, that is—no combined carbon—if the oxygen was kept at very low limits, but that a small trace of oxygen would upset the balance.

Mr. Morrogh, replying to Mr. Dunlop's question, said he was reasonably sure that the findings of the investigator to whom he had referred were absolutely correct. In fact there was no need to eliminate oxygen from the melt to make it solidify so that all one had was iron and carbon. All one had to do was to cool it sufficiently slowly, and he suggested that even if all the oxygen from the melt were removed and then it were cooled sufficiently rapidly, one could also get iron carbide structures. There did seem to be some inter-relation between deoxidisation and inoculation, and he referred to the point he had made in the paper about the better inoculation obtained when the inoculant also contained a deoxidising element such as zirconium, aluminium and perhaps calcium.

The Search for Equilibrium in Practice

Mr. A. E. Peace suggested they should not let the novelty of the spherulitic graphite cast iron detract their minds from the value of the exposition of graphite formation. He considered that an outstanding feature of the Paper also was the part described as "The Nature of Graphite in Cast Iron." That was a summary, added to, he thought, by Mr. Morrogh's own investigations, the like of which had not previously existed. After the work of the Authors with all types of graphite there was not an enormous number of elementary facts concerning graphite that they did not now know, and the known facts were assembled logically here together, which was what he wanted to emphasise.

There were a few other points Mr. Morrogh had made, which Mr. Peace felt metallurgists did not recall to their minds sufficiently often. One very important point was in the introduction, where Mr. Morrogh had said that equilibrium studies of cast iron were of little avail in understanding the commercial material. Mr. Peace thought everyone should bear that constantly in mind, for in practice there were no well-defined conditions for establishing an equilibrium. Even in such a case as the production of malleable cast iron, where a great effort was made to reach equilibrium, and stable conditions were actually obtained, they had not in fact reached equilibrium; they were very close to it, but still it had not been reached. Another point he emphasised was the note that the proximity of microstructural graphite to cementite also tended to cause it to be less stable. This was well known to students of malleable cast iron metallurgy, and it was a statement to which he drew their attention.

When Mr. Morrogh had been dealing with the spherulitic material and the nature of its formation, he had spoken about this graphitisation taking place at lower temperature than the flake graphitisation, and said that the spherulites were formed because of the lack of malleability in the matrix. They knew in making blackheart cast iron where there was a lack of malleability in the matrix much greater than, for example, in white cast iron, spherulites were not formed, but there were instead graphite aggregations which they called nodules.

Mr. Morrogh was very gratified Mr. Peace had raised that point, because the explanation of the way spherulites formed during the solidification of a casting was obviously limited. The restrictive effect of the matrix was only part of the question, and undoubtedly nuclei were required to guarantee that the nodular graphite occurred in the spherulitic pattern. In malleable iron, particularly in whiteheart practice, it had been observed—and the Paper* which was to follow gave further information on this point—that the type of sulphide nuclei determined the type of the graphite nodules. The Authors had found they could get graphite flake aggregates and spherulitic nodules during the solidification of a casting. He was unable to answer just what the nuclei were in the case of nickel-carbon alloys which produced this spherulitic pattern. They were not visible under the microscope, but undoubtedly from various pieces of evidence which the Authors had, they were very necessary.

(*Continued on page* 114.)

*"Annealability of White Iron for the Manufacture of Malleable Cast Iron," by S. W. Palmer, A.R.I.C.

The Annealability of White Iron in the Manufacture of Malleable Iron*

By S. W. Palmer, A.R.I.C., A.I.M.†

(*Continued from page* 94.)

Mechanical Test Results

From an examination of the mechanical test results presented graphically in Fig. 2, one can detect definite trends in properties related to an increasing value for the sulphur/manganese ratio. The tensile strength, in general, tends to decrease with an increase in this value. Some melts show an initial increase in tensile strength before this decrease becomes pronounced, and in some melts the fall in tensile strength is marked when the sulphur just reaches excess. In most of these melts the yield strength remains reasonably constant, while in others the tendency is for the yield strength to increase slightly when an excess of sulphur is reached.

In nearly all these melts the elongation value increases with increasing sulphur relative to the manganese, until the stabilising influence of the manganese upon the pearlite is removed by the combination of this element with the sulphur and the maximum amount of ferrite is permitted to occur in the matrix. When the sulphur reaches excess and free ferrite is again absent from the general matrix, the elongation falls sharply in most of these melts.

The bend test results were rather disappointing. While the results for some melts show trends similar to the elongation values, they are generally erratic and no particular emphasis is being placed upon them at this stage. It is interesting to note that in a number of cases the highest bend value obtained from a melt was obtained from the bar having the highest sulphur content.

Neutralisation of Sulphur by Manganese

Using the metallographic evidence referred to previously, a chart (Fig. 18) was drawn in which all the compositions studied were plotted according to their sulphur and manganese contents. Those compositions found by microscopic examination to give no ferrite around the temper carbon, compact or spherulitic nodules and divorced pearlite were represented by a small circle, and those compositions which gave

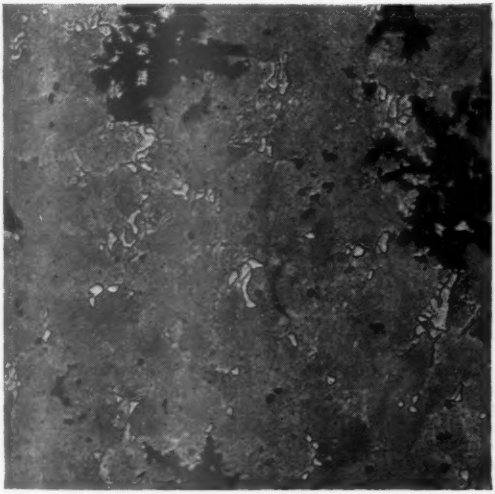

FIG. 13.—BAR NO. 17A. MANGANESE 0.45 PER CENT.; SULPHUR 0.052 PER CENT.

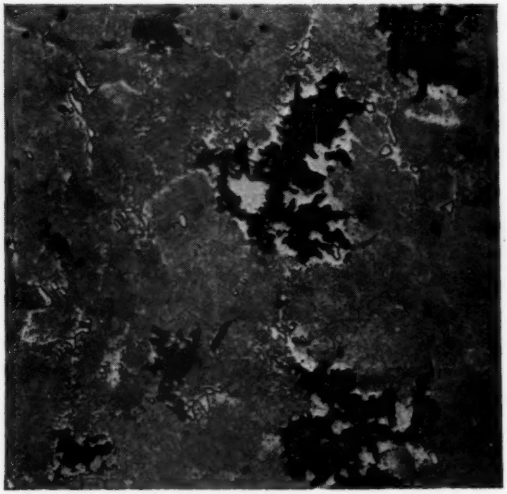

FIG. 14.—BAR NO. 17B. MANGANESE 0.45 PER CENT.; SULPHUR 0.111 PER CENT.

MAGNIFICATION × 120. ETCHED IN 4 PER CENT. PICRAL.

*Presented at the Nottingham Conference of the Institute of British Foundrymen.

†British Cast Iron Research Association.

Annealability of White Iron

ferrite associated with the nodules and/or fine pearlite were represented by a cross. On dividing the chart by a straight line indicating the compositions at which the sulphur is the chemical equivalent of the manganese, it was found that, with very few exceptions, the circles lay on the sulphur-rich side and the crosses on the manganese-rich side of the line. This graphical presentation of the metallographic evidence has also indicated the range of compositions in which spherulitic temper carbon nodules, as opposed to temper carbon aggregates, occur in the microstructure. Those compositions containing spherulites have also been indicated by N, and a brief examination of the chart readily indicates the range of chemical compositions with respect to manganese and sulphur in which spherulites are formed. This area has been marked off with a dotted line in Fig. 18.

At this stage it is appropriate to consider some of the implications of the data as set out in Fig. 18. Compositions lying towards the lower right-hand corner would have sulphides consisting predominantly of manganese sulphide. On moving from this corner in the direction of the upper left-hand corner, the manganese sulphide would contain increasing amounts of iron sulphide in solution. At some point approaching the line Mn = 1.72 × S, iron sulphide may be observed in the microstructure at room temperature, but beyond the line iron sulphide will become increasingly apparent as the upper left-hand corner is approached. In the region

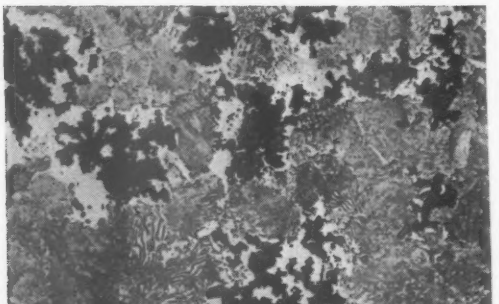

FIG. 15.—BAR NO. 17C. MANGANESE 0.45 PER CENT.; SULPHUR 0.181 PER CENT.
MAGNIFICATION × 120. ETCHED IN 4 PER CENT. PICRAL.

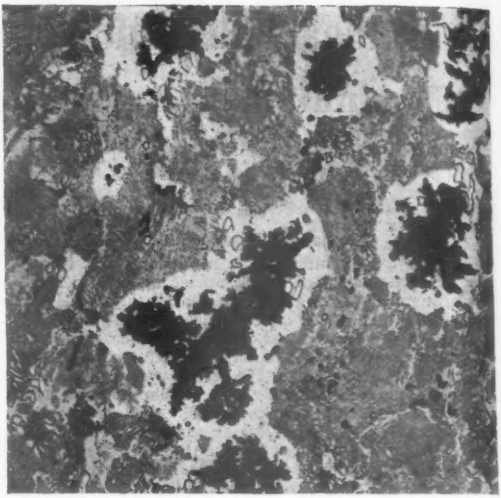

FIG. 16.—BAR NO. 17D. MANGANESE 0.45 PER CENT.; SULPHUR 0.254 PER CENT.
MAGNIFICATION × 120. ETCHED IN 4 PER CENT. PICRAL.

lying roughly between the line Mn = 1.72 × S and the dotted line marking off the spherulitic compositions, whilst iron sulphide may be visible at room temperature, it will tend to be all or partly dissolved in the manganese sulphide at the annealing temperature. This is due to the well-known solubility of iron sulphide in manganese sulphide,[5,6] which increases markedly with increasing temperature.

Much further work remains to be carried out on the relationships between the type of structure produced and the mode of occurrence of sulphur (that is, whether it is present as MnS or FeS or both) at the annealing temperature. It is possible, for instance, that the spherulite-producing compositions marked off with the dotted line correspond with those compositions giving free iron sulphide at the annealing temperature. Whatever may be the outcome of further work along these lines, it is apparent from the results presented here so far that a critical condition exists when the manganese present is the chemical equivalent of the sulphur, *i.e.*, when Mn per cent. = 1.72 × S per cent. Furthermore, it would seem that for the optimum mechanical properties, particularly with regard to elongation in relatively heavy sections, that the manganese content should be slightly in excess of the value 1.72 × S per cent. This is similar to the recommendation made by Taylor.[7]

Depth of Decarburisation and the Sulphur/Manganese Relationship

During the metallographic examination of the microspecimens taken from the 0.875-in. bars, a measurement of the distance from the extreme edge to the start of the

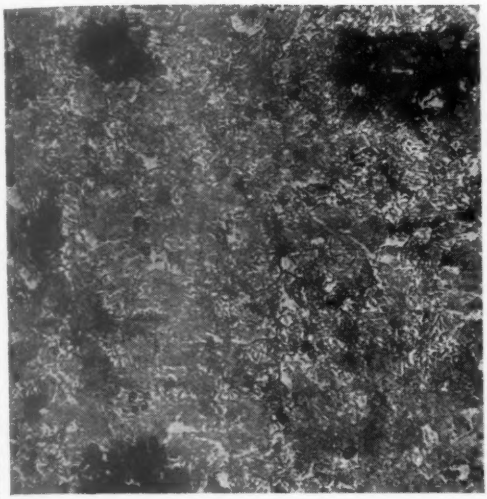

FIG. 17.—BAR NO. 17E.. MANGANESE 0.45 PER CENT.; SULPHUR 0.310 PER CENT. MAGNIFICATION × 120. ETCHED IN 4 PER CENT. PICRAL.

continuous pearlite rim was determined, as illustrated in Fig. 19, for each specimen, and taken as a convenient indication of the depth of decarburisation. These measurements were made in millimetres, and are plotted against the sulphur/manganese value on the graphs given in Fig. 2.

It is apparent from these decarburisation curves that, although some melts show a gradual increase in the amount of decarburisation with increasing sulphur, the majority of them show little increase in this respect until the sulphur reaches excess. This point is indicated by a marked increase in the depth of decarburisation, and in practically all cases the materials containing the higher sulphur contents had experienced the deeper decarburisation.

Concluding Comments on Section I

The experiments described in this section are regarded as being only of a preliminary nature. Some interesting features have certainly emerged from the work to date. Definite trends have been obtained for tensile strength, yield strength and elongation value with an increasing sulphur/manganese ratio. These trends, of course, will have to be confirmed by closer and more numerous increments in manganese and sulphur contents, and will no doubt bear relation to the corresponding changes in microstructure. The effects of increasing sulphur contents on the microstructure and the occurrence of temper carbon in materials containing a range of manganese contents between 0.1 and 0.5 per cent. have been clearly shown.

The neutralising of the carbide stabilising influence of the manganese by increasing sulphur has been shown to increase the amount of ferrite in the matrix. As soon as sulphur reaches excess, the matrix becomes almost entirely pearlitic, and with further increases in sulphur the amount of divorced pearlite increases. When the manganese content is slightly in excess of the sulphur content, secondary graphitisation during cooling is allowed readily to proceed to give large lakes of ferrite associated with the temper carbon. As soon as the sulphur content reaches excess, this secondary graphitisation on cooling is retarded, and no ferrite occurs associated with the temper carbon. Considerable excess of manganese is an undesirable feature.

The chemical relationship and neutralisation of sulphur by manganese as these two elements occur in malleable iron have been metallographically confirmed to be related to the simple equation based on their chemical equivalents. Silicon appears to have very little influence upon this relationship. It is therefore possible to anticipate the influence of the manganese or sulphur contents in a material upon the microstructure, given the actual percentages of these elements.

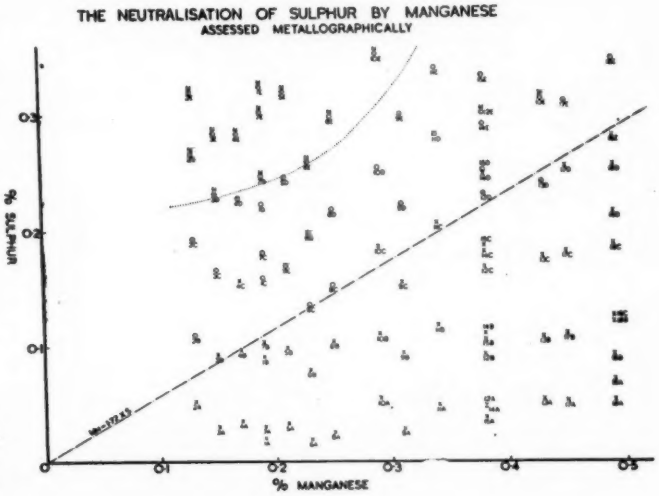

FIG. 18.

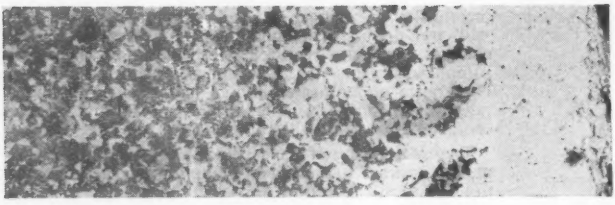

FIG. 19.—MEASUREMENT USED TO REPRESENT DEPTH OF DECARBURISATION.

It is evident that the depth of decarburisation progressively increases with increasing sulphur content, some melts indicating a marked increase in the amount occurring when the sulphur passes to excess. This influence of sulphur on the depth of the pearlite rim from the surface may be of some importance when machinability is a leading consideration.

The apparent effect of silicon content has not been very pronounced in these experiments to date. As would be expected, the lower silicon contents, particularly when in combination with large excess manganese contents have induced the persistence of eutectic cementite, while on the other hand, the higher silicon contents have encouraged the occurrence of eutectic graphite. The higher silicon contents have also shown a tendency to promote larger nodules. The actual effect of silicon content in these experiments will be more clearly discussed and demonstrated in Section III of this Paper. It must be appreciated that all the results included in the foregoing were obtained from an annealing cycle having a relatively short heating-up period, *i.e.*, a rapid rate of heating.

SECTION II

The Annealability of Blackheart Malleable Iron

In the annealing of white iron to produce normal blackheart malleable iron, the metallurgist has two main points to consider and control in order to produce the necessary fully annealed material in the shortest possible time. The first of these is the nature and extent of the first stage graphitising period, when the eutectic cementite content of the white iron is decomposed or dissolved eventually to give a structure of temper carbon in austenite. The second, but equally important factor, is the nature and duration of the second stage graphitising period, during which the carbon remaining in solution is precipitated on to the already existing temper carbon aggregates, this process eventually producing a structure of temper carbon in a matrix of ferrite in the fully annealed material. It is generally agreed that when the metal composition conforms to within the normal limits, particularly of carbon, silicon, phosphorus and manganese, for a given section size, then the annealing process is reasonably straightforward and the required mechanical properties are readily obtained.

Unfortunately, however, for the manufacturers of normal blackheart malleable iron, the basic materials available at the present time invariably contain small percentages of what are termed special or residual elements, such as chromium, nickel, copper, etc. Some of these residual elements, in small amount, have little or no effect upon the annealability of the white iron which they contaminate, while several residual elements may even exert a beneficial influence on annealability. There are certain residual elements, however, which are known, or are suspected, to prolong first stage graphitisation, and to render second stage graphitisation diffi-

TABLE II.—*Composition of Alloyed Melts.*

Melt No.	T.C. Per cent.	Si. Per cent.	Mn. Per cent.	S. Per cent.	P. Per cent.	Alloying Element or Treatment.
1	2.39	1.00	0.35	0.047	0.059	0.55 per cent. Nickel.
2	2.30	0.97	0.40	0.049	0.054	0.08 per cent. Aluminium.
3	2.18	0.92	0.39	0.050	0.056	0.38 per cent. Copper.
4	2.16	0.95	0.36	0.056	0.056	0.03 per cent. Ti (0.1 per cent. added).
5	2.12	0.96	0.38	0.049	0.33	0.33 per cent. Phosphorus.
6	2.11	0.92	0.41	0.058	0.058	0.16 per cent. Arsenic.
7	2.39	1.04	0.33	0.058	0.060	0.06 per cent. Antimony.
8	2.39	0.99	0.32	0.058	0.061	0.025 per cent. Bismuth.
9	2.25	0.83	0.33	0.059	0.060	0.08 per cent. Boron.
10	2.14	0.98	0.40	0.058	0.059	0.24 per cent. Chromium.
11	2.19	0.97	0.40	0.059	0.055	0.16 per cent. Molybdenum.
12	2.40	1.01	0.32	0.062	0.060	0.17 per cent. Tellurium.
13	2.29	1.14	0.32	0.059	0.069	0.16 per cent. Tin.
14	2.26	1.01	0.42	0.064	0.064	0.12 per cent. Tungsten.
15	2.12	0.92	0.41	0.055	0.056	0.13 per cent. Vanadium.
16	2.19	0.92	0.73	0.057	0.058	0.73 per cent. Manganese.
17	2.22	0.98	0.32	0.38	0.059	0.38 per cent. Sulphur.
18	2.17	0.99	0.40	0.059	0.057	Blank.
19	2.19	1.05	0.30	0.057	0.060	Arc melt.
20	2.32	0.90	0.34	0.058	0.056	Oxidised scrap.

cult. It is probably during the second stage graphitisation period that residual carbide stabilising elements exert the most harmful effect, their presence leading to the persistence of pearlite in the matrix, even after prolonged second stage treatment. The use of oxidised metal is also known to retain pearlite in the otherwise fully annealed material.

With these points in mind the Author recently carried out a group of experiments arranged to throw some light upon the effect on annealability of various alloying elements that are likely to occur as residual elements in blackheart malleable iron. Some interesting features of these experiments are described in the following.

Preparation of Test-bars and Compositions Studied

The test bars, $\frac{3}{4}$ in. × 1 in. × 9 in., were obtained from coke-fired crucible furnace melts using a basic charge which was essentially the same for all the melts. An additional melt was carried out in an electric rocking arc furnace to produce test bars that might give some indication of the effect of different melting conditions upon annealability. It was intended that the basic composition of all these melts should be of the order of total carbon 2.0 to 2.3 per cent., silicon 0.95 to 1.05 per cent., manganese 0.35 to 0.4 per cent., sulphur 0.05 to 0.06 per cent., and phosphorus at a maximum of 0.06 per cent. The amounts of alloying elements contained in these melts were regarded as being the highest likely to occur as residual elements in white iron for blackheart malleablising.

The chemical compositions, alloy contents and treatment of these melts are given in Table II.

It will be noticed that melts containing 0.33 per cent. phosphorus, 0.73 per cent. manganese, and 0.38 per cent. sulphur have been included in these experiments, and also a melt in the charge of which a quantity of oxidised annealing pan scrap was included to give "oxidised" metal. All these melts contributed test bars to the annealing experiments.

First Stage Annealing Experiments

Ten test bars of each of the 20 melts were used to investigate first stage graphitisation. One test bar of each melt was grouped in each of ten batches, each batch being in the form of a conveniently wired-up bundle. These ten bundles of bars were placed in a cold electrically-heated furnace, and the temperature was raised to 930 deg. C. in 4 hours. A steady temperature of 930 deg. C. was maintained throughout the first stage anneal. The ten batches of bars were successively removed from the furnace after the following intervals of time:

Batch No. 1	5½ hours after reaching 930 deg. C.
2	7½ ,, ,, ,, ,,
3	10½ ,, ,, ,, ,,
4	14 ,, ,, ,, ,,
5	20 ,, ,, ,, ,,
6	27 ,, ,, ,, ,,
7	38 ,, ,, ,, ,,
8	52 ,, ,, ,, ,,
9	72 ,, ,, ,, ,,
10	100 ,, ,, ,, ,,

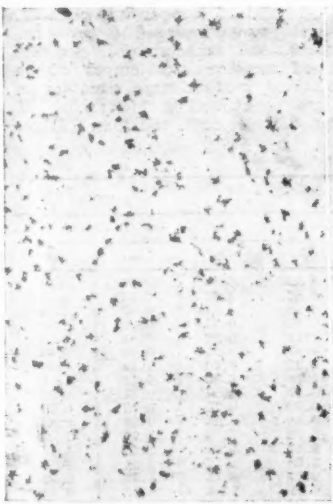

FIG. 20.—MELT NO. 2. Al. VERY SMALL NODULES.

FIG. 21.—MELT NO. 6. As. MEDIUM SIZED NODULES. MAGNIFICATION × 60. UNETCHED.

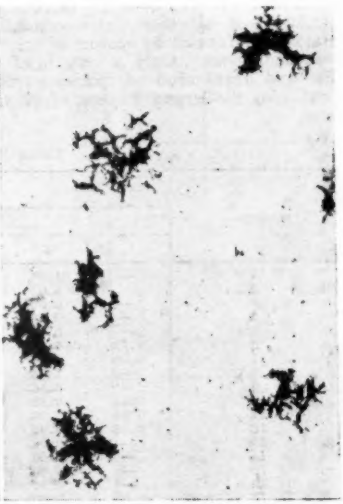

FIG. 22.—MELT NO. 13. Sb. LARGE NODULES.

Annealability of White Iron

It was anticipated that the greater amount of cementite breakdown and graphitisation resulting from it would occur early on during the first stage anneal, particularly in those melts containing alloying elements known to accelerate graphitisation. The above times of removal of test bars from the furnace were therefore arranged on an approximate logarithmic scale, which resulted in the removal of five of the ten batches from the furnace during the first 20 hours of the anneal. Immediately on removal from the furnace, each batch of bars was quenched in a large tank of water at room temperature, this quenching treatment being employed to prevent any further graphitisation during cooling.

It was not found practicable in the first stage anneal to protect the test bars during annealing by the normal methods employed in the blackheart process, namely of packing them in annealing boxes containing some inert packing material. After annealing and quenching, all test bars were cut into two halves, one half to be used for providing a sample for chemical analysis, and the other half to provide for microscopic examination.

Results of Microscopic Examination

A microspecimen was prepared from the complete cross-section of each ½ in. test bar. The specimens were examined in the unetched condition to determine temper carbon size and distribution, and then in the etched condition to determine the amount or presence of undecomposed eutectic cementite. The microstructure of all these bars consisted basically of martensite, formed by reason of the drastic quenching treatment given. Only a very brief summary of the size and distribution of temper carbon in those bars containing the largest amount of graphite is attempted here.

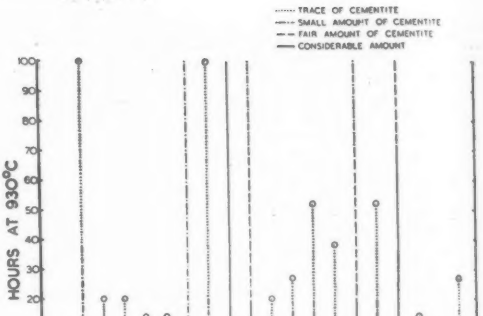

FIG. 23.—TIME OF REMOVAL OF CEMENTITE DURING FIRST STAGE ANNEALING.

Melt No. 2 (aluminium 0.08 per cent.) contained numerous very small temper carbon aggregates; Melt No. 8 (bismuth 0.025 per cent.) contained many small sized aggregates of temper carbon; Melts Nos. 1, 4, 5, 16, 18 and 19 (nickel 0.55 per cent., titanium 0.03 per cent., phosphorus 0.33 per cent., manganese 0.73 per cent., Blank and arc melts respectively) contained small to medium-sized temper carbon aggregates; Melts Nos. 3, 6, 11, 14 and 15 (copper 0.38 per cent., arsenic 0.16 per cent., molybdenum 0.16 per cent., tungsten 0.12 per cent., and vanadium 0.13 per cent. respectively) contained medium-sized temper carbon aggregates. Medium to medium-large sized temper carbon aggregates were contained in Melts Nos. 10, 12 and 25 (chromium 0.24 per cent., tellurium 0.17 per

TABLE III.—*Extent of Graphitisation during First Stage Treatment.*

Melt No.	Graphitic Carbon, per cent.									
	Batch No.									
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1	—	1.06	0.99	1.04	1.10	1.11	1.16	0.88	1.01	0.76
3	—	1.01	1.05	1.16	1.10	1.16	1.02	1.09	1.11	1.05
3	—	0.92	0.94	0.90	1.04	1.01	0.98	0.87	0.97	0.74
4	—	0.92	0.95	0.84	0.99	0.98	0.84	0.77	0.78	0.50
5	—	0.99	1.05	1.04	1.06	1.04	1.11	0.86	0.84	0.54
6	0.79	0.84	0.78	0.85	1.00	1.05	0.87	0.89	0.90	0.74
7	0.86	0.96	1.03	0.94	1.04	1.00	0.95	1.16	1.14	0.50
8	—	1.25	1.07	1.17	1.23	1.38	1.19	1.23	1.17	1.06
9	—	0.40	0.40	0.37	0.50	0.47	0.41	0.50	0.41	0.39
10	0.61	0.63	0.53	0.79	0.75	0.80	0.78	0.72	0.75	0.56
11	0.96	1.06	1.02	1.00	1.04	0.99	0.98	0.96	0.89	0.83
12	0.82	0.99	0.88	1.02	1.03	0.94	1.12	1.14	1.02	1.07
13	—	0.89	1.01	1.17	1.30	1.02	1.13	1.03	1.23	1.09
14	—	0.99	1.08	1.12	1.16	1.27	1.18	1.12	1.11	0.98
15	—	0.62	0.68	0.73	0.86	0.81	0.73	0.71	1.00	0.70
16	—	0.57	1.08	1.06	0.90	1.27	0.99	1.04	0.87	0.58
17	0.05	0.06	—	0.25	0.11	0.45	0.10	0.11	0.12	0.10
18	—	1.00	1.06	1.03	1.15	0.96	0.93	0.93	1.00	0.80
19	1.01	1.14	0.97	1.16	1.10	1.09	1.12	1.06	0.95	0.65
20	0.97	1.14	1.04	1.22	1.13	1.13	1.11	1.10	0.79	0.60

cent., and oxidised metal respectively). Melts Nos. 7 and 13 (antimony 0.06 per cent. and tin 0.16 per cent.) contained large sized temper carbon, in Melt No. 7 as compact nodules and in Melt 13 as ragged aggregates. The melt containing 0.08 per cent. boron contained a small amount of temper carbon in the form of very small particles, and the melt containing 0.38 per cent. sulphur contained a small number of temper carbon nodules. In order to provide a guide to the relative sizes of temper carbon referred to in the foregoing, the temper carbon distribution in Melts Nos. 2, 6 and 13 are shown in photomicrographs under Figs. 20, 21 and 22. Fig. 20 is representative of what have been described as " very small," Fig. 21 of " medium sized," and Fig. 22 of " large sized " nodules.

The amounts of eutectic cementite persisting in these melts during the progress of the first stage annealing experiments are illustrated diagrammatically in Fig. 23. The small circle indicates the point at which eutectic cementite was no longer visible in the microstructure. It will be seen from this diagram that eutectic cementite remained in Melts Nos. 7, 9, 10, 15 and 17 (containing antimony 0.06 per cent., boron 0.08 per cent., chromium 0.24 per cent., vanadium 0.13 per cent., and sulphur 0.38 per cent. respectively) after 100 hours of first stage annealing at 930 deg. C. This 100-hour period was just sufficient to decompose all cementite in Melts Nos. 2 and 8, these containing aluminium 0.08 per cent., and bismuth 0.025 per cent. respectively.

On the other hand, Melts Nos. 1, 5, 6, 18 and 19 (containing nickel 0.55 per cent., phosphorus 0.33 per cent., arsenic 0.16 per cent., Blank and arc melt) required only 15 hours or so in order completely to remove all eutectic cementite, and this was the case with Melts Nos. 3, 4 and 11 (containing copper 0.38 per cent., titanium 0.03 per cent., and molybdenum 0.16 per cent.) after 20 hours annealing. Melt No. 13, containing tin 0.16 per cent., and No. 17, containing manganese 0.73 per cent., required 50 hours first stage annealing, while Melts Nos. 12, 14 and 20 (containing tellurium 0.17 per cent., tungsten 0.12 per cent., and oxidised metal) required up to 38 hours to remove all cementite.

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5 Shibata, Z., Technology Reports of the Tohoku Imperial University, 1928, vol. 7, September, pp. 279-289.
6 Whiteley, J. H., Iron and Steel Institute, Seventh Report on the Heterogeneity of Steel Ingots, 1937, pp. 23-55.
7 Taylor, E. R., Iron and Steel Institute, Carnegie Scholarship Memoirs, 1926, vol. 15, pp. 381-406.

(To be concluded.)

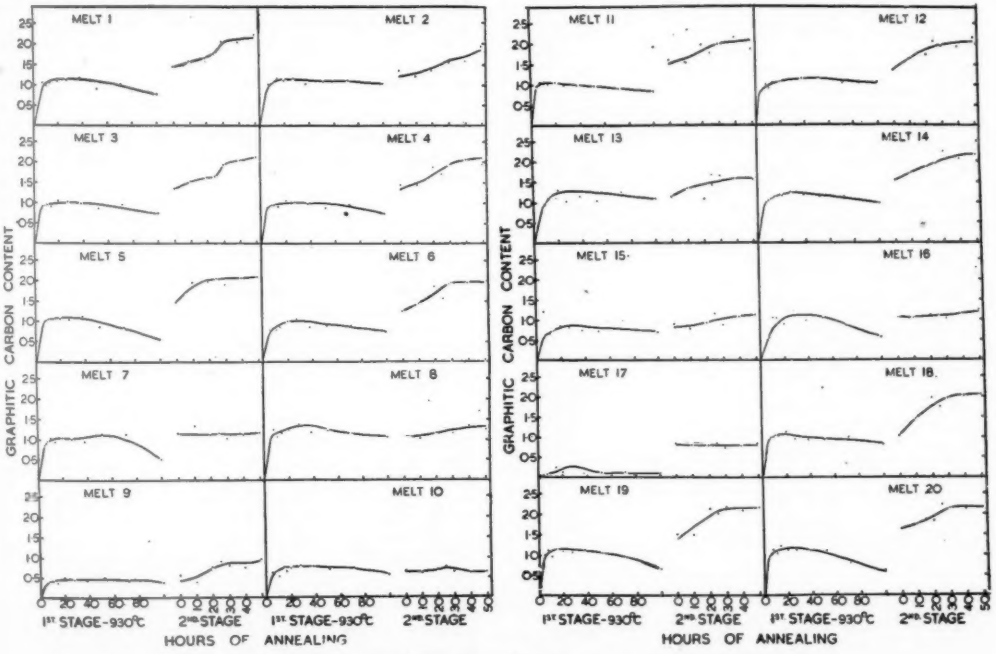

FIG. 24.—GRAPHITE CONTENT ACCORDING TO ANNEALING TIME.

The Crisis and South Africa

Speaking at the Annual General Meeting of the Transvaal Engineers' and Founders' Association, Mr. D. Lion Cachet said he felt it was very heartening that men who had seen the industry develop on the Reef from the very beginning were still prepared to carry on their arduous duties, year after year, for the benefit of the industry. He recalled how the engineering industry had progressed and developed during the two world wars until to-day South Africa found herself stronger in industry than ever before and in the process of even greater expansion for the future.

Mr. Lion Cachet, emphasising that in these days of political strife throughout the world, facts had to be clearly faced, said, "If we review the world position to-day, and more particularly the British Commonwealth of Nations, then we find a Britain which is very weak indeed. We in South Africa, as a comparatively small member of the Commonwealth, can use our industry in two ways—in a highly competitive way and enter those markets which Britain cannot supply, or, on the other hand, we can use it in a sympathetic manner and keep in the back of our minds the support of Britain and how to further her interests. Obviously, I am in favour of the latter course. On the other hand, we must not retrogress, as we must build our industry on a solid foundation for the great Commonwealth decentralisation which will have to take place in the near future, for the obvious reason that our industrial might is too concentrated and therefore vulnerable. To-day, more than ever, it is necessary for the members of the Commonwealth to stand closely together and look into the future, as obviously a house which is consolidated within itself will always prosper. We must do our utmost to look at the problems of a member of the Commonwealth, in this case Britain, sympathetically from within instead of critically from the outside."

"The time at our disposal for preparation of decentralisation and building the foundation of a great industry, which this continent can obviously support due to its mighty natural resources, is short. This Association tonight has decided to start a bursary scheme: in my opinion that is one of the most important steps you have made. We must train the best brains in the industry, from whatever sphere of life they might come, as in the race of development there will be no time to work with inefficiency. We must scientifically pick and train our young men, train them for the great future of South Africa and the Commonwealth, which must stand in the world as a tower of strength beyond doubt." Recently he said he came across the Chinese proverb which read: *Enjoy yourself, it is later than you think.* To convey how strongly he felt on this subject, he would like to change this to *Get on, hurry, it is later than you think.*

MRS. F. D. HEYWOOD, PH.D., B.SC., has been elected President of The Women's Engineering Society for the year 1947-48.

Country Jobbing Foundries

Our representative recently took a trip into the heart of the country to see how two local jobbing foundries were faring under the modern set-up. Neither was too badly off for materials or labour. The first foundry was attached to an engineering concern. It was light, airy, essentially neat, well lighted and, we were assured, reasonably warm in winter. There was a new cupola, serviced by electrically hoisted barrows to the stage. A mono-rail served the casting floor; the moulds were cast up on Tuesdays and Fridays. Of a staff of about a dozen, there were three apprentices. No moulding machinery was in use, but there was a small August-Simpson mill for sand preparation. Both ferrous and non-ferrous (including light alloys) were being made. No piece work was undertaken and the production per unit floor space was extremely low.

By contrast, the second foundry was housed in a poor type of building, but the production per unit floor space was remarkably high. Moulding was effected by Sandslinging. The home-made sand hopper serving the machine was filled by a Pneulec Royer. The boxes were resting on lengths of home-made roller conveyors. A new cupola was in process of construction, as the owner—a young Cambridge arts graduate—was unable to buy one on reasonable delivery terms. There was a jolt-ram turn-over machine placed contiguous to the roller conveyor system. All boxes were knocked out in the same spot. Here in the making was the genesis of what some day will be an important unit of the foundry industry. But the owner must insist on some of the neatness of the first foundry visited, which, in its turn, would do well to emulate the manufacturing methods of the second.

Graphite Formation

(*Concluded from page* 106.)

MR. H. G. HALL, speaking as a member of the Research Committee, said he had watched the development of this discovery over several years, and he could state that the findings were a result of logical developments. He expressed his sincere appreciation of the work that had taken place.

Vote of Thanks

Thanking the Authors for their Paper, the CHAIRMAN (Mr. R. B. Templeton) said it was a great contribution to the better understanding of cast iron, and one which the ironfounding industry would carefully follow in the next few years. The Authors had advanced a theory, but they had also done more than that. They had applied it, and they had brought out some very important practical developments from the application and the better understanding of the mechanism of solidification. The chairman was sure the work now being done by the British Cast Iron Research, under the able direction of Mr. Pearce, was going to be a great help in the future.

Carbon Pick-up in Melting Cast Iron*

By P. H. Shotton

It is a frequent experience of foundrymen to find a rise in carbon in their metal, sometimes desired, but more often otherwise. The effect of high carbon is varying, and what is a high carbon content for one class of work, is low for another. Rise in carbon is often found in cupola melting, and the lower the initial content of the charge, the greater the pick-up, a heavy steel charge absorbing much greater quantities than a charge low in steel. There are two ways in which carbon contents are raised, namely, by absorption of solid carbon from the fuel, and that introduced by means of carbon monoxide in the atmosphere of the furnace. In the first instance it has been noticed many times that metal held in the well of the cupola, usually has a greater carbon content than metal which is running through a syphon brick or other continuous tapping device. This extra carbon can only come from the coke in the well of the furnace, and is therefore absorption from solid carbon. The second case, where carbon is picked up by carbon monoxide, is usually found in pick up by steel scrap as it descends from charging door to melting zone. Rambush and Taylor pointed out that: "The steel scrap nearest the lining absorbs more carbon than that nearer the centre," and this may be due to greater quantities of gas and carbon monoxide passing there, than rising through the centre of the stack. The well known dished shape of the melting zone and cone shape of high temperature up the stack probably also influence this, as steel nearer the lining would be at a greater temperature than that in the centre at the same level in the furnace. These two factors no doubt combine to give the results experienced by the two investigators. A similar reaction is found in carburising steel bars in charcoal. The bars are carburised (in the normal way), by heating at between 900 deg. C. and 1,000 deg. C., but by the addition of barium carbonate, or other alkaline earth carbonate, additional amounts of carbon monoxide are generated and the concentration maintained at a higher level than before by some carbon dioxide reacting with barium oxide to form barium carbonate again.

Results from a high percentage of steel can be seen in charges for high duty irons. These sometimes consist of 50 per cent. pig and cast iron, and 50 per cent. steel, and having an initial carbon content of 1.90 per cent. Three per cent. carbon metal is tapped and a pick up of 1.10 per cent. is therefore obtained. Using a greater percentage of steel, 70 per cent. and an initial carbon content of 1.4 per cent. iron may come from the cupola at 3.2 per cent., giving an increase of 1.8 per cent. The influence of coke is of utmost importance as will be seen by altering the variety used. The use of hard dense coke would not be expected to yield a higher carbon pick-up than one that is soft and of an open nature. The close coke would not offer so much surface area in the well of the cupola, and with the same volume of air for burning would not yield so much carbon monoxide in the preheating zones. Another factor making itself felt in this interesting study is the height of the coke bed, and it seems the general opinion that the higher the coke bed, the higher the pick up in carbon. Summarising the conditions favourable to increased carbon content, we have:—A long interval between taps, the use of a coke of open texture, a high coke bed, insufficient air so as to give the maximum of carbon monoxide, and a charge that is prone to pick up carbon such as one containing a high percentage of steel.

Electric and Rotary Furnace Practice

Turning to other methods of melting cast iron, it is found that carbon pick-up is more often desired than not for reasons of fluidity and freedom from casting troubles. The only means of increasing carbon in the the electric and rotary furnaces is by actual contact, the carbon being dissolved in the metal. A variety of carbonaceous materials may be used such as ground coke, wood charcoal, ground furnace electrodes, plumbago, blacking, ground anthracite, and petroleum coke, and according to one report on electric furnace melting, the most efficient pick up is obtained from ground electrodes. Of the five carbonaceous materials, they are said to be in the following order of efficiency:—Ground electrodes, blacking, wood charcoal, finely ground coke, and plumbago, the material being placed on the furnace bottom and the furnace charge on top. In the rotary furnace, the carbonaceous material may be charged first and the metal on top, or it may be added when the charge material is becoming molten by throwing it into the pasty mass and allowed to become more intimately mixed by rotating. Additions of carbonaceous materials after the charge is molten, are not very satisfactory, as they may float on the surface of the slag or be blown down the chimney flue and lost as soon as the flame is reintroduced. After the charge is properly molten, carbon content of metal has to be controlled by means of a suitable slag covering. In rotary furnace melting, the addition of carbonaceous materials does not always give a greater carbon content than that originally charged, but merely compensates for the loss of carbon.

Crucible melting gives similar results to electric furnace melting when any carbon addition must be made, by allowing the metal to flow over coke or some other carbonaceous material contained in a secondary ladle or crucible.

*An entry from a Short Paper Competition organised by the Birmingham, Coventry and West Midlands Branch of the Institute of British Foundrymen.

Foundry Practice No. 88, July-August

Issued by Foundry Services, Limited, Birmingham, 7, contains articles on the making of cast aluminium core plates, ironfounding, die casting, melting cast iron, nickel bronzes and similar alloys.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

ABBREVIATIONS

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—As a subscriber to the JOURNAL please allow me to criticise a fault, common to many other journals alike. This is the use of abbreviations standing for some body, term or organisation without indicating what the letters mean. To you and those steeped in any subject or intimately associated with any body, abbreviated names are household words, and you are apt to take it for granted that everybody else who buys the paper is also familiar with their use. New readers in particular are not conversant with them, and I feel that *in any issue* where abbeviations are used repeatedly (and I agree they are necessary) the *original* use should embrace also their meaning. Your "Chaos and Cost" leader, for example, this week refers constantly to "C.F.A." and "R. C. Sheppard's 'P.M.H.'" values (although the latter was made clear in a former issue, but only then *after* it had been used several times).—Yours, etc., J. ROSTRON.

38, Windsor Place,, Mangotsfield, nr. Bristol.
September 30, 1947.

[We quite agree, and will make every endeavour in the future to ensure clarity.—EDITOR.]

"A CORE GOES AWRY"*

To the Editor of THE FOUNDRY TRADE JOURNAL

SIR,—A good method in a case of this sort is to ram core-sand (preferably synthetic) into a wrought iron tube of the diameter of the core required. The tube, complete with sand—after drying—is then inserted in the mould, and a good casting is assured. An ordinary bottom gate is all that is required to cast the job successfully. I trust this hint will be of benefit to fellow foundrymen.

Yours, etc.,
A. SERGEANT.

"Bank Mawr,"
Sketty, Swansea.
Sept. 27, 1947.

* This letter has reference to an article on core movement, published in the FOUNDRY TRADE JOURNAL, September 18.—EDITOR.

B.C.I.R.A. Elects New Members

The following firms have joined the British Cast-Iron Research Association. The name of the representative is shown between brackets.

Bailey, Pegg & Co., Ltd., Brierley Hill (Mr. A. H. Chappell); Dudley Foundry Co., Ltd., Brierley Hill (Mr. W. E. Harper); North Foundries, Limited, Manchester (Mr. C. Renwick); Qualters & Smith Bros., Ltd., Barnsley (Mr. W. L. Williams); Reynolds Bros., Ltd., Chilwell (Mr. J. H. Reynolds); and Thomas Robinson & Son, Ltd., Rochdale (Mr. J. C. Robinson).

Notes from the Branches

South Africa

The annual dinner and general meeting was held at the Carlton Hotel, Johannesburg, on June 26. About 100 members and guests were present. Mr. J. H. West, the president, welcomed the numerous distinguished guests, amongst whom were Mr. F. C. Williams, the secretary of employers' federations,, Mr. W. G. Jackson, president of the S.A. Institution of Engineers; and Mr. A. G. Thomson, Editor, "Engineer and Foundryman." The President, in an address, contrasted the papers given when the Branch was first established some years ago with those of to-day. The progress had been very considerable, and the future was being cared for by the creation of a junior section. Specialised foundrywork was being evolved from what the President called being "Jobbers to the Mines."

The President, who came into office in the middle of the last session, together with the vice-president, Mr. H. Tewbes, were re-elected, and the following were elected to the Council:—Mr. Tickton, Mr. Anderson, Mr. Lane, Mr. Bill and Mr. Godwin.

The function was interspersed with speeches from Mr. Leon Cachet; Mr. F. C. Williams, who characterised the Branch as "the most active technical body in the Transvaal to-day"; Mr. Tonge; Colonel Guy; and Mr. Davidson, who offered a special welcome to the newcomers from overseas.

London Branch—East Anglian Section

A party of 27 members of the East Anglian Section participated in a visit to the Standard Ironworks of Davey Paxman & Company, Limited, Colchester. The tour of the works included the machine shop, erecting shop, boiler shop, inspection and test shops, laboratory, patternshop and foundry. After the visit the members were entertained at tea, during which the President, Mr. R. F. Coates, in responding to an address of welcome by Mr. Howe, expressed the thanks of the members to the management for having accorded them permission to inspect the works, and to Mr. Carrott, the foundry manager, and the other guides for their patience in explaining the points of interest throughout the tour. On leaving, souvenir booklets of Colchester and Davey Paxman were distributed.

New Catalogue

Aluminium and Aluminium Alloys. The Eyre Smelting Company, Limited, of Willow Lane, Mitcham, Surrey, have just issued a 22 page well-printed booklet, which neatly sets out the properties of a wide range of ingots they produce for the light alloy founders. The alloys listed are those most generally specified—L33, DTD 424; "Y" and the like. Thus correlation between trade brands and specified alloys is unnecessary. The presentation of the booklet between black covers with the printing in embossed aluminium letters is very effective.

British Iron and Steel Industry

Statistics for 1946

Statistics covering iron ore, pig-iron, iron castings, wrought iron, steel ingots and castings, semi-finished and finished steel, including production and distribution, raw materials consumed, imports and exports, labour and prices are included in the British Iron and Steel Federation's Statistical Year Book for 1946. Copies are obtainable (price 5s.) from the British Iron and Steel Federation, Steel House, Tothill Street, London, S.W.1. The volume follows the general lines adopted in the previous year. New tables published for the first time give details of the size of existing blast furnaces and steel furnaces, imports by product and country of consignment, exports by product and country of destination, and the sources of the iron ore consumed. Parts II and III of the Year Book will be published later, dealing respectively with iron and steel tariffs in operation in each country and statistics of the iron and steel industries of overseas countries throughout the world. Appended are some of the salient statistics relating to 1946 contained in Part I, with the 1945 figures in parentheses.

Pig-iron Production

Blast Furnaces.—At the end of 1946 existing blast furnaces numbered 157 (168), and there were two under construction. Hearth diameters varied from less than 10 ft. to 18 ft. and over, with a number of intermediate sizes; thus there were 16 hearths of less than 10 ft. diameter; 36 of 10 ft. and under 12 ft.; 37 of 12 ft. and under 14 ft.; 36 of 14 ft. and under 16 ft.; 17 of 16 ft. and under 18 ft.; and 15 of 18 ft. diameter and over.

Pig-iron Production.—During the year, pig-iron output, including blast-furnace ferro-alloys, totalled 7,761,200 tons (7,107,400), including hematite 1,121,000 tons (1,076,200); basic, 5,288,300 tons (4,883,700); foundry, 1,134,500 tons (964,000); forge, 65,900 tons (51,900); direct castings, 1,400 tons (300), and ferro-alloys, 150,100 tons (131,300). In the various producing districts the output was as follows: Derby, Leicester, Notts., Northants and Essex, 1,782,900 tons (1,697,300); Lancashire (excluding the North-West Coast), Denbigh, Flint, Cheshire and Yorkshire (excluding the North-East Coast), 353,900 tons (349,000); Lincolnshire, 1,070,900 tons (1,039,100); North-East Coast, 1,901,500 tons (1,663,800); Scotland, 602,600 tons (542,200); Staffs., Salop, Worcestershire and Warwickshire, 342,800 tons (338,800); South Wales and Monmouth, 1,010,900 tons (864,000); North-West Coast, 695,700 tons (613,200).

Raw Materials Consumed.—Materials used in the production of pig-iron and blast-furnace ferro-alloys included 9,851,000 tons (11,169,300) of native iron ore and manganese ore, raw and calcined as charged; 5,314,800 tons (3,471,500) of imported ores on the same basis; sinter, 2,282,700 tons (2,297,000); limestone, 1,913,500 tons (1,955,600); scrap, 568,500 tons (545,400); other materials, including purple ore, cinder, slag and scale, 787,000 tons (769,900); total, 20,717,500 tons (20,208,700). Coke consumed, 8,582,700 tons (8,191,600); coal equivalent of coke consumption calculated on the basis of 100 tons of coal yielding 66 tons of coke, 12,851,300 tons (12,266,400). Materials consumed per ton of pig-iron and ferro-alloys included: Home ore, 25.38 cwt. (31.43); imported ore, 13.70 cwt. (9.77); sinter, 5.88 cwt. (6.46); limestone, 4.93 cwt. (5.50); scrap, 1.46 cwt. (1.54); other materials, 2.03 cwt. (2.17); total, 53.38 cwt. (56,87). Coke consumed per ton of pig-iron, 22 cwt. (22.93); coke in terms of coal, 33.24 cwt. (34.52). The average output of pig-iron and ferro-alloys per furnace in 1946 was 79,300 tons (71,700).

Steel-ingot Production

Open-hearth Furnaces.—There were 110 acid open-hearth furnaces in this country at the end of 1946, these including 27 furnaces of up to 30 tons capacity; 31 to 40 tons, 38; 41 to 50 tons, 9; 51 to 60 tons, 26; 61 to 80 tons, 4, and 81 to 100 tons, 6. There were also 339 basic open-hearths, including 23 of up to 40 tons capacity; 41 to 50 tons, 65; 51 to 60 tons, 67; 61 to 80 tons, 87; 81 to 100 tons, 50; 101 to 150 tons, 23; 151 to 200 tons, 5; and over 200 tons, 19.

Steel Production.—Output of steel ingots and castings in 1946 amounted to 12,695,300 tons (11,824,400). It included acid-Bessemer 209,800 tons (170,700); basic-Bessemer, 723,800 tons (687,000); acid open-hearth, 1,185,700 tons (1,111,900); basic open-hearth, 9,890,000 tons (9,014,000); electric ingot steel, 345,000 tons (361,400); electric steel castings, 134,300 tons (180,600); all other ingots and castings, 206,700 tons (298,800). Production of alloy steel, excluding high-speed steel, was 519,300 tons (706,500); high-speed steel ingots, 15,700 tons (13,300).

Raw Materials Consumed.—Materials used per ton of non-alloy and alloy steel ingots and castings averaged 25.59 cwt. (25.76), including hot and mixer pig-iron, 6.38 cwt. (6.08); cold pig-iron, 3.22 cwt. (3.50); steel scrap, 11.47 cwt. (11.62); cast-iron scrap, 0.58 cwt. (0.56); oxides, 1.14 cwt. (1.13); finishings, 0.29 cwt. (0.31); fluxes, 1.79 cwt. (1.82); fettling materials, 0.72 cwt. (0.74). Coal used per ton of steel not included in the foregoing totals of materials, averaged 32.3 cwt. (35.0).

Deliveries of non-alloy semi-finished steel of prime quality in 1946, included light re-rolling billets, blooms and slabs, 3,105,600 tons (2,716,000); forging billets, blooms and slabs, 240,900 tons (230,500); sheet bars and sheet slabs, 1,535,000 tons (1,427,600); tinplate bars, 676,800 tons (603,600).

Finished Steel Output

Finished steel production, excluding alloy steel, included heavy rails and sleepers, 468,900 tons (370,100); heavy and medium plates, 1,607,000 tons (1,372,000); other heavy steel products, 1,658,400 tons (1,688,100); light-rolled products, excluding wire rods and alloy steel bars, 2,544,900 tons (2,180,100); ferro-concrete bars, 167,500 tons (91,900); cold-rolled strip, 220,900 tons (209,400); bright steel bars, 231,900 tons (221,500); sheets, coated and uncoated, 1,163,800 tons (1,052,400); tin, terne and black plate, 543,200 tons (495,000); tubes, 726,300 tons (566,700); mild-steel wire, 478,800 tons (411,600); hard-steel wire, 132,800 tons (120,500); tyres, wheels and axles, 174,500 tons (126,600); drop forgings, 145,800 tons (174,600); other forgings, 110,900 tons (97,200); castings, 152,400 tons (212,400). Alloy finished steel production included plates, 13,400 tons (55,700); tubes, 12,800 tons (14,000); bars, sheets, strip and wire, 149,500 tons (156,900); drop forgings, 62,800 tons (81,100); other forgings, 22,200 tons (37,100); castings, 28,600 tons (49,100); shell steel, nil (34,600). The foregoing figures together total 10,817,300 tons (9,818,600), of which the products of alloy steel represented 289,300 tons (428,500).

Persons in actual employment in the industry at the middle of 1946, totalled 282,900 (289,000), made up as follows: Iron-ore mines, 7,100 (8,600); coke ovens, 13,300 (12,700); blast furnaces, 16,600 (15,900); steel melting and rolling, etc., 170,900 (174,800); tinplate manufacture, 12,100 (12,400); tube making, 33,200 (34,700); wire, and wire-netting manufacture, 29,700 (29,900).

Anniversary of Cox & Danks, Limited

This year marks the twenty-fifth anniversary of the incorporation of Cox & Danks, Limited, iron and steel scrap merchants, etc., and also the fortieth wedding anniversary of Mr. E. F. Cox, the founder and governing director of the company, and Mrs. Cox. The events were celebrated at a function at Grosvenor House, Park Lane, London, W.1, on October 2. Mr. and Mrs. Cox were presented with a walnut book-case and silver rose bowl by Mr. George Atkinson, the joint managing director, on behalf of the directors and staff. In proposing the toast of the company, Mr. J. H. Rhynd referred to the work of Mr. Cox in raising the scuttled German fleet at Scapa Flow after the first world war, which made the name of his company a household word in the scrap industry.

News in Brief

ISAAC LUTTERWORTH, LIMITED, ironfounders, etc., of Rochdale, have recently celebrated their jubilee.

A PARTY OF French provincial newspaper executives recently visited the Vickers Works, Sheffield, of the English Steel Corporation, Limited, where they made a tour with Rear-Admiral J. F. C. Patterson, a special director of the company.

THOS. W. WARD, LIMITED, Albion Works, Sheffield, have formed a subsidiary company, the Société Thos. W. Ward (Belgium), S.A. The office of the company is located at 8, Longue rue des Claires, Antwerp, with Mr. J. Bronkhorst as the responsible manager.

AT THE ANNUAL GENERAL MEETING of the British Shipbuilding Research Association held in Edinburgh on September 30, Sir G. Tristram Edwards and Sir A. Murray-Stephen were re-elected chairman and vice-chairman respectively, for the ensuing year.

G. E. SIMM (SURPLUS IN MODERN MACHINERY), LIMITED, have moved to new works at 270, Attercliffe Road, Sheffield. They have also opened a branch office at 5, Dock Chambers (telephone: Cardiff 6677). Mr. L. E. Davies will manage the Cardiff office.

THE MOSS HUTCHISON LINE, LIMITED, Liverpool, has placed an order with Harland & Wolff, Limited, for two motorships of 4,500 tons d.w. The hull of one of the new ships will be built in Belfast and the other at Govan. Machinery for both will be made at Belfast.

PEGSON, LIMITED, Coalville, Leics, who designed and built crushing plant used in the new Cape Town harbour works, have secured a contract to supply crushing machinery in connection with the construction of Europe's largest hydro-electric installation, some 250 miles from Madrid.

THE MINISTRY OF SUPPLY has announced the following interim allocations of tin metal by the Combined Tin Committee for the second half of 1947:—Ceylon, 18 tons; Egypt, 34; Finland, 22; Ireland, 18; Palestine, 66; New Zealand, 129; Yugoslavia, 116; Australia, 150, making a total of 553 tons. These allocations were not included in previous announcements.

A SUBSTANTIAL EXPANSION of basic-iron production is promised on the North-East Coast. The new blast furnace at Consett, which has a designed capacity of 700 tons a day, was lighted up on September 26, replacing a smaller obsolete furnace, and two blast furnaces at one of Dorman, Long & Company's works have been blown in after being re-lined and modified.

SANDERSON BROS. & NEWBOULD, LIMITED, Sheffield steelmakers, have obtained Treasury permission to issue 214,192 ordinary 10s. shares to ordinary shareholders at 15s. each on a "rights" basis of one for one. Another 41,536 shares are being offered on the same terms to the management and staff. Net proceeds of the issue (£185,000) will be devoted to repaying a bank overdraft and financing the increased cost of larger stocks, besides repairs and extensions.

Personal

MR. S. E. NORTH, managing director of Jarrow Tube Works, Limited, has left for Norway on a business trip.

MR. SETH S. SOMERS, chairman of Walter Somers, Limited, Halesowen, has been elected an honorary member of the Iron and Steel Institute to mark the completion of 50 years' membership.

MR. R. G. MCELWEE, foundry alloy division manager for the Vanadium Corporation of America, Detroit, has been elected chairman of the Grey Iron Division of the American Foundrymen's Association.

MR. G. SMELLIE, formerly deputy works manager of the Port Talbot Works, has been appointed works manager in charge of the Margam and Port Talbot Works of the Steel Company of Wales, Limited.

MR. R. J. M. WHIBLEY, of the Churchill Machine Tool Company, Limited, Manchester, has been awarded the Constantine gold medal for his Paper on the "Production of Flat Surfaces," read before the Manchester Association of Engineers.

MR. ARTHUR J. WILLIAMS has been appointed chief engineer in charge of the construction of the new cold-reduction plant of the Steel Company of Wales, Limited, at Trestre, Llanelly, in succession to MR. J. P. ASHLEY, who is retiring.

SQUADRON-LEADER R. H. MARKS, who, since the end of the war, has been a director of an export company in London, has been appointed assistant secretary of the North-Western Regional Office at Manchester of the Federation of British Industries.

MR. WILLIAM WILSON, senior partner in the firm of W. W. Wilson & Company, average agents and consulting engineers, of Newcastle-upon-Tyne, has been appointed Swedish vice-consul at Newcastle in succession to the late Mr. Ridley Warham.

MR. C. ASHLEY MILLER, general manager of G. Beaton & Son, Limited, manufacturers of motor accessories and aircraft components, of Willesden, London, N.W.10, has been appointed a director of the company in place of the late Mr. Gerald Sturt.

MR. A. A. TIMMINS has resigned the honorary secretaryship of the Birmingham branch of the Institute of British Foundrymen. MR. A. J. SHORE, 16, Goodrest Avenue, Quinton, Birmingham (a past-president), has been appointed acting secretary until the next annual general meeting.

MR. JOHN M. ROBB, Jr., Philadelphia resident manager of Hickman, Williams & Company, has been appointed chairman of the general arrangements committee for the 1948 convention and exhibition of the American Foundrymen's Association to be held in Philadelphia on May 3-7, 1948.

COL. TERENCE MAXWELL has tendered his resignation as prospective Unionist candidate for the Acocks Green division of Birmingham, owing to pressure of work required by business interests. He is a director of Vickers, Limited, and other companies. Col. Maxwell is shortly leaving on a mission to Australia.

MR. H. M. DALE (Pyrene Company, Limited) was installed as president at the annual meeting of the Purchasing Officers' Association on September 27. MR. W. G. CLIFF (Electric Construction Company, Limited) will serve as a vice-president during the coming year, while the chairman will be MR. T. F. TURNER (English Electric Company, Limited).

MR. JOHN RYAN, vice-chairman of the Metal Box Company, Limited, is one of the six members of the Resale Price Maintenance Committee appointed by the President of the Board of Trade to make a general inquiry into the practice of resale price maintenance. DAME ANNE LOUGHLIN (Trades Union Congress) will also serve on the Committee.

MR. W. C. T. CHANTLER and MR. G. MORAY STEPHENSON have been appointed to the board of Jack Olding & Company, Limited, manufacturers of agricultural tractors, etc., of Hatfield, Herts. Mr. Chantler has been general manager of the company since 1940 and has a total service of over 20 years, while Mr. Stephenson, who has acted as assistant to the chairman, Mr. Jack Olding, has been with the company for 10 years.

MR. L. H. COOPER, a director of the Mond Nickel Company, Limited, has been elected assistant secretary and assistant treasurer of the International Nickel Company of Canada, Limited. This appointment is additional to his present position in the Mond Nickel Company, and he will continue to be located in London. Mr. Cooper joined the Mond Nickel Company in 1926, and was secretary of the company for 11 years prior to his election to the board in 1945.

MR. HUGH MURDOCH, J.P., and COUNCILLOR A. G. LOGAN, O.B.E., were honoured last week by members of the former Ironfounding Workers' Union Executive Committee. In the spring the Ironfounding Workers' Union became the Amalgamated Union of Foundry Workers, and Mr. Murdoch and Mr. Logan retired at that time as officers of the Union after having completed over 50 years' active service, Mr. Murdoch as general secretary and Mr. Logan as organising secretary.

MR. D. SHARPE, a past-president of the Institute of British Foundrymen and a director of Walter MacFarlane & Company, Limited, architectural and sanitary ironfounders, of Glasgow, and Foundry Plant & Machinery, Limited, Glasgow, is leaving for South Africa for an extended business trip lasting four months. He hopes to visit all the large cities, and South African foundrymen will be able to profit by hearing of his long experience with the Sandslinger and other developments which he has pioneered in this country. His address for the near future will be care of Thos. Cook & Sons, Limited, Cape Town.

D. MEREDEW, LIMITED, of Cabinet Works, Dunhams Lane, Letchworth, Herts, have opened a department for the supply of foundry pattern boards made from ¼-in. or 1-in. fir ply, suitable for use with moulding machines.

Company News

(Figures for previous year in brackets.)

Ferranti—Dividend of 6%, tax free (same).

Superheater—Interim dividend of 20% (15%).

Stedall & Company—Interim dividend of 7½% (same).

G. Hopkins & Sons—Interim dividend of 6% (same).

Spurling Motor Bodies—Interim dividend of 12½% (10%).

W. H. Dorman & Company—Dividend of 37½% (25%).

Premier Metal of South Africa—Dividend of 12½% (same).

Thos. Firth & John Brown—Interim dividend of 2½% (same).

Telegraph Condenser Company—Interim dividend of 5% (nil).

James H. Lamont & Company—Interim dividend of 5% (same).

British United Shoe Machinery—Interim dividend of 6% (same).

Electrical Components—Dividend of 12½% (nil), making 20% (nil).

Cochran & Company, Annan—Final dividend of 5%, making 6½% (5%).

John Thompson Engineering Company—Interim dividend of 5% (same).

Erinoid—Final dividend of 15% (10%) and bonus of 5% (nil), making 20% (10%).

Glynwed Tubes—Interim dividend of 12½% (two interim dividends of 5% and 7½%).

Imperial Smelting Corporation—Final dividend of 5% and bonus of 1%, making 6% (same).

F. Reddaway & Company—Interim dividend of 5% (same); no further payment is recommended.

Electrolytic Zinc Company of Australasia—Final dividend of 9% and bonus of 2½%, making 17½% (11%).

Renold & Coventry Chain Company—Final dividend of 12% (9½%) and a bonus of 2½%, making 15% (same).

Stewarts and Lloyds—Interim dividends for the half-year ended June 30 last on the 6% cumulative first, 10% second, and 5% third preference stocks.

Larmuth & Bulmer—Profit for the year ended March 31, after depreciation, taxation, etc., £7,476; final dividend of 12½%, making 15%; forward, £14,747 (£13,467).

Leeds Fireclay Company—Ordinary dividend of 6% (nil); final dividend of 4% on the 6% participating preference shares, making 8% (first and final payment of 5%).

Beralt Tin & Wolfram—Profit for the year ended March 31, £108,123; to taxation reserve, £48,050; dividend of 25% (10% and bonus of 5%); forward, £44,445.

Pearson & Knowles Coal & Iron Company—Net profit for the year ended June 30, £39,907 (£32,336); writing off the balance of the deficiency account, £10,589; forward, £2,191 (nil).

Associated British Engineering—Net revenue for the year ended March 31, £48,997 (£23,630); dividend of 12% (same); to dividend equalisation account, £20,000 (£3,000); forward, £18,933 (£8,587).

Dubilier Condenser Company (1925)—Net profit, after depreciation, tax, etc., for the year ended March 31, £22,578 (£29,822); to general reserve, nil (£14,675); dividend of 20% (same); forward, £32,687 (£24,076).

W. H. Dean & Son—Net profit to August 13, £74,546 (£83,383); to general reserve, £20,000 (same); dividend equalisation reserve, £10,000 (same); final dividend of 40%, making 50% (same, including bonus of 25%); forward, £23,714 (£22,168).

Alexander Stephen & Sons—Profit for the year ended March 31, after charging depreciation and making provision for taxation, £92,370 (£108,265); to general reserve, £50,000; dividend of 8%, making 15%, and a bonus of 3%; forward, £150,651 (£131,717).

Kay & Company (Engineers)—Net profit for the year ended May 31, after taxation, depreciation, etc., £31,837 (£30,781); to employees' bonus fund, etc., £1,000 (same); general and plant reserve, £11,000 (£8,000); written off goodwill, £5,000 (nil); dividend of 20% (17½%); forward, £13,168 (£10,431).

Stothert & Pitt—Net profit for the year ended June 30, after income tax, bank interest and charges, directors' fees, £74,829 (£73,160); dividend of 10% (same) and bonus of 5% (same); to general reserve, £35,461 (£30,000); victory gifts to workmen's benevolent fund, etc., £2,000 (nil); forward, £67,804 (£57,380).

Staveley Coal & Iron Company—Trading profit, after providing for management expenses, for the year ended June 30, £620,888 (£701,857); dividends from investments, £300,490 (£265,768); profit on sale of investments, etc., nil (£3,593); transfer-fees, £281 (£186); deferred repairs, nil (£50,000); written off shares in subsidiary companies, nil (£42,812); loss on sale of investments, £7,223 (nil); taxation, £259,350 (£304,726); depreciation written off, £164,616 (£200,672); directors' fees, £11,000 (same); net profit, £479,470 (£362,194); to general reserve, £50,000 (same); final dividend of 7½%, tax free (same), making 12½% (10%), tax free; forward, £173,214 (£166,914).

Ransome & Marles Bearing Company—Trading profit for the year to June 30, £443,321 (£251,453); E.P.T. recoverable, net, nil (£25,353); interest received, £407 (£1,788); transfer fees, £81 (same); accumulated overseas balances now agreed, £28,129 (nil); excess taxation reserves in previous years, £25,000 (nil); directors' fees, £1,700 (£1,666); E.P.T. and profits tax, £48,000 (nil); income tax, £155,500 (£89,844); depreciation, £85,779 (£59,794); net profit, £205,959 (£127,371); profit on investment realised, £4,687 (nil); final dividend of 12½% (same) and bonus of 5% (nil), making 25% (20%); to general reserve, £115,000 (£50,000); directors' remuneration, £3,000 (same); forward, £79,757 (£83,361).

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New Companies

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Billingtons Boston Foundry, High Street, Sandyford, Staffs—£2,000.

Walsall Foundry, Croft Street, Walsall, Staffs—£4,000. L. J. Yarnall and G. A. Millward.

Castle Foundry (Keighley), Castle Foundry, Becks Road, Keighley—£2,000. A. Peckover and W. Cox.

Metal Powders—£10,000. O. Jestrabek, 82, West Gate Bay Avenue, Westgate-on-Sea, Kent, subscriber.

J. W. Young & Sons, Mayfield Works, Redditch—Precision engineers, etc. £50,000. J. R., H. and E. E. Young.

Foundry (Engineers) Patterns, 1, Woodland Way, Shirley, Croydon, Surrey—£1,000. N. C. Fisher and S. D. A. Saunders.

Wrights of Diss, 95, Victoria Road, Diss, Liverpool—Agricultural and general engineers, etc. £15,000. A. F. and R. H. Wright.

H. Birch & Son, 49-51, Victoria Road, Cambridge—General engineers, etc. £5,000. F., E. M. and B. E. E. Birch, and J. A. Raynor.

Stainless Steel Fabricators, Sunnyside Works, Whitworth, Rochdale—£3,000. H. Buswell, F. Smith, F. Leach and G. P. Luckman.

T. E. Linnett Startin, 106-114, Emily Street, Birmingham—Metal small-wares manufacturers. £100,000. T. E. L. and E. H. Startin.

Maundrell Foundries, The Foundry, Calne, Wilts—Agricultural engineers. £20,000. G. J. Welch, R B. Jenkins and A. A. R. Oxford.

Hundridge Foundry, River Plate House, 12 & 13, South Place, London, E.C.2—£1,600. E. R. B. Farrar, G. W. Green and P. Freeman.

Ornamental Ironworks, 1a, Netherwood Place, London, W.14—£3,000. H. S. and G. D. Jennings, W. H. Pash, and R. H. Pickford.

W. H. Donnelley & Company (Metals), 346, Abbey House, Victoria Street, London, S.W.1—£1,000. W. H. Donnelley and A. L. S. Parfect.

Burtt, Burtt & Cawley, Dowsby Hall, nr. Bourne, Lincs—Manufacturers of tractors, excavators, etc. £6,000. H. Burtt and R. E. Reynolds.

Harry Tootell (Blackburn), 9, Duke of Sussex Street, Blackburn—Iron, steel and metal merchants. £5,000. H. and M. Tootell, and I. K. Grimshaw.

Bayswater Tubes & Sections—Tube and section manipulation engineers, etc. £3,000. P. J. Saunders, 8, Pitfold Close, London, S.E.12, subscriber.

W. J. Thyer & Company, Huntspill, near Highbridge, Som—Agricultural engineers. £40,000. W. V. Gledhill, E. J. Tomlinson, and J. K. Radcliffe.

Refractories (South Wales), Cymric Buildings, The Docks, Cardiff—£4,000. I. R. Morgan, L. J. Matthews, R. W. Clough, C. M. Possart and J. Slack.

Stanley Butterworth, Victory Forge, Winterton Road, Scunthorpe—Agricultural engineers. £3,000. S. Butterworth, J. N. Grant, and S. Butterworth.

Northern Metal Spinning Company, 1, Stockport Road. Delamer Place, Chester Square, Ashton-under-Lyne—£2,000. P. F. Dodd, F. P. and T. H. Gill.

Griffiths, Bentley & Company, 21, Hermitage Road, Edgbaston, Birmingham—Manufacturers of metal pressings. £10,000. H. S. Griffiths and H. C. Kelly.

Walter Frank & Sons, 437, Wakefield Road, Staincross, near Barnsley—Engineers and ironfounders. £20,000. A. D., W. R. B., B. H., and K. B. Frank.

Kington Foundries (Hereford), 43, Barnford Crescent, Langley, Oldbury, nr. Birmingham—£1,000. W. H., C. E. and T. Sabin, F. Davis and H. Darby.

Castor Foundry & Manufacturing Company, 6, Sherborne Road, Newton Abbot—£5,000. M. C. Taylor, E. W. Cale, J. A. Wilson, and C. A. J. Peplow.

Nuckey Scott & Company, Warrior Works, Compton Avenue, London, N.1—Engineers and tool manufacturers. £50,000. P. Nuckey, R. J. Scott and F. S. Gaylor.

Hargreaves, Hamilton & Company (Engineers), Thynne Street Works, Thynne Street, Bolton—£50,000. C. Hargreaves, S. Seddon, T. Edwards, A. Lomax and J. Nuttall.

Mosspits Foundry & Engineering Company, Mosspits, High Heath, Pelsall, nr. Walsall—£1,000. A. E. Woodward, G. J. L. Garner, J. Arblaster and R. O. Hammond.

H. W. Hancock & Company, Hardwick's Factory, 104, Ackwright Street, Nottingham—Engineers and patternmakers—£1,500. J. W. and M. A. Mitchell, and J. Cleasby.

C. A. Hoare & Company, Victoria Foundry, Dubb Lane, Bingley, Yorks—Iron and brass founders, etc. £2,000. C. A. Hoare, J. S. Stark, P. Dacey, and J. Robertshaw.

Henry Kelland & Company, 6, King Square, Bridgwater, Som—Manufacturers of agricultural machinery, etc. £11,000. F. and J. Dolding, B. H. White, and V. C. Burston.

G. & H. C. Hackett Bros., 83, Malt Mill Lane, Blackheath, Worcs—Manufacturers of iron and steel nuts, screws and bolts, etc. £3,000. J. H., G., and H. C. Hackett.

Chadd Casting Company, Dixon Street, Monmore Green, Wolverhampton—£3,000. V. Hornig, F. W. Dunkey, J. G. Archer, W. C. Cossington, J. G. Haynes and W. H. Steele.

Bishop Manufacturing Company (Birmingham), 52-55, Milk Street, Birmingham—Machinists, makers of press tools, moulds, jigs, etc. £9,000. M. Tooth, A. J. Unitt and S. Holloway.

A. H. Hunt, Bendon Valley, Garratt Lane, Wandsworth, London, S.W.18—Manufacturers of electric generating plant and machinery. £125,000. C. H. and M. D. Hunt, S. H. Brewell, and F. S. Richmond.

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Raw Material Markets

Iron and Steel

Order-books are extremely heavy, and with sufficient supplies of pig-iron and other raw materials foundries could be very active for a long period ahead. At present, a good deal of the commitments are for heating and cooking apparatus, rainwater goods, etc:, but as these are to be curtailed under the Government's export plan future developments are uncertain. The general engineering and speciality foundries are engaged on high-duty castings for machinery. Supplies of pig-iron are unchanged, and it is to be hoped that arrangements will be made for additional quantities. The tendency, however, is to put in furnaces for the production of steelmaking pig, although more iron is being used in many of the .foundries owing to the scarcity of suitable cast-iron and steel scrap. This is unfortunate in view of the fact that licensed quantities for pig-iron are at a low level due to the heavy demand and restricted supply. Summer deliveries of coke, in most cases, have been up to the scheduled tonnages, and, in many places, small reserve stocks have been accumulated. Stocks of ganister, limestone, etc., are also fairly good.

Production of semis by home makers is on the upgrade, but there are insufficient billets, blooms and sheet bars to keep all the re-rollers at maximum production, although their order-books for finished sheets, strip, bars, light sections, etc., warrant the highest output. Small imported supplies of semis are still coming through, but quantities are insufficient to fill the gap. Steelworks experience no difficulty in finding ready outlets for any defective billets, sheet bars, crops, etc. Export quotas of finished bars, strip, etc., during the last few quarters have been reduced to comparatively small dimensions, but it is thought that Period IV may show some improvement in this direction.

There is no easing of the situation at the heavy steelworks for supplies of plates, sections, joists, heavy rounds and flats. All mills are overwhelmed with orders, and a bigger proportion of output is having to be found for P.M.L. priorities. These include steel for underground use at the collieries, such as arches, roofing bars, props and rails, and works dealing with these have their output for the next two or three periods fully taken up. All rail mills are booked up for a long time to come, and wire mills, too, are inundated with business. Long delivery periods are named for new orders at the strip mills. The pressure for bright-drawn steel and many forms of specials is not so great, although it is constant. There continues to be a very strong call for stainless and spring steels. Deliveries of certain classes of tube are very belated, owing to the wide demand for strip. Structural engineers are held up by the slow pace at which supplies of sections and joists are coming through, and contractors engaged on gasworks', electrical and other urgent plant are also short of supplies.

Non-ferrous Metals

Copper is showing little sign of any activity at present, and the United Kingdom internal selling price is still maintained well above the world price level, which seems to be established at 21¼ cents per lb., f.a.s. New York.

Mr. W. M. Warren, presiding at the meetings of Larut Tinfields, Kundang Tin Dredging, Jelepang Tin Dredging and Berjuntai Tin Dredging, recently, referred to the heavy export tax on Malayan tin, and said that projected taxation must take the place of the existing system and not be superimposed. Failure to recognise this would result in abandoning the development of the low-grade tin areas, which formed a major portion of Malaya's reserves. Mr. Warren added that within the next two years tin production would probably be ahead of consumption, and steps should then be taken to safeguard against the possibility of over-production.

Lead prices remain unchanged, and the United Kingdom quotation is still well above the world level. Supplies in this country are fairly comfortable at the moment, due to plentiful supplies of scrap, but the future outlook does not appear to be too promising. The U.S. market is firm, consumers showing more interest.

Recent Wills

HADEN, C. I., of Trowbridge, of G. N. Haden & Sons, Limited, engineers £178,467

CLARK, ROBERT, of Darlington, governing director of John Tinsley, Limited, mining-machinery manufacturers, etc. £13,947

ADSHEAD, T. W., of Kinver, Staffs, for many years managing director of Thos. Adshead & Sons, foundrymen, etc., of Dudley, Worcs £1,379

CULLIFORD, C. H. H., of Bristol, for 30 years a co-director of Priest & Mullings, Limited, constructional and mechanical engineers, of Bristol ... £63,901

WHITEHOUSE, W. H., late director of T. Whitehouse & Sons, Limited, galvanisers and japanned hollow-ware manufacturers, of Lye, Stourbridge, Worcs £2,919

ELLIOTT, CYRIL, of Erdington, Birmingham, exhibition organiser and consulting engineer, a former general manager of the heavy section of the British Industries Fair £7,512

URE, G. A., of Bonnybridge, Stirling, chairman and managing director of Smith & Wellstood, Limited, stove and boiler manufacturers, etc., and of the Esse Cooker Company £61,321

MCLINTOCK, C. H., of Banstead, Surrey, partner in Thomson McLintock & Company, a director of the Ashley Engineering Company, Limited, and of British Ropes, Limited, Doncaster £125,919

GIBSON, SIR J. W., of Stanwell, Middx. Deputy Director-General of Civil Engineering (Special) at the Ministry of Supply, 1943-1944, who was responsible for the construction of the Mulberry Harbours £61,136

ALEXANDER, A. M., of Trimingham, Norfolk, consulting engineer, consultant vice-chairman of Creeds, Limited, telegraph engineers, of Croydon, and a former vice-chairman of the Thames Iron Works £16,561

MIDDLETON, DR. A. H., of Consett, Co. Durham, a well-known figure in the coal-carbonisation and refractory industries, and late general manager of the coke and brickworks department of the Consett Iron Company, Limited £21,282